

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Hideyasu MATSUMURA et al. **Confirmation No. 4013**
Group Art Unit : 1796
Appl. No. : 10/540,866
Examiner : Winkler, Melissa A
I.A. Filed : March 22, 2004
For : EXPANDABLE RESIN BEADS OF STYRENE-MODIFIED, STRAIGHT
CHAIN, AND LOW-DENSITY POLYETHYLENE, PROCESS FOR THE
PRODUCTION THEREOF, PRE-EXPANDED BEADS AND EXPANDED
MOLDED ARTICLE

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Commissioner for Patents
U.S. Patent and Trademark Office
Customer Service Window, Mail Stop Appeal Brief - Patents
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Sir:

This Appeal is from the Examiner's (repeated) Rejection of claims 1-16 set forth in the Office Action mailed from the U.S. Patent and Trademark Office on March 21, 2008.

The fee for filing an Appeal Brief as set forth in 37 C.F.R. § 41.20(b)(2) is being paid concurrently herewith.

A Notice of Appeal in response to the March 21, 2008 Office Action was filed on July 18, 2008.

Inasmuch as this Appeal Brief is being filed within the initial two-month period prescribed by 37 C.F.R. § 41.37(a)(1), set to expire September 18, 2008, it is believed that no extension of time is required. However, the Patent and Trademark Office is hereby authorized to

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charge any fee necessary for maintaining the pendency of this application, including any appeal or extension of time fees that may be necessary, to Deposit Account No. 19-0089.

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Sekisui Plastics Co., Ltd. of Osaka, Japan. The corresponding assignment was recorded in the U.S. Patent and Trademark Office on June 27, 2005 at REEL 017331, FRAME 0457.

II. RELATED APPEALS AND INTERFERENCES

On July 25, 2008 Appellants filed a Notice of Appeal with respect to the rejection of the claims of co-pending application Serial No. 10/541,391. The claims of the present application have provisionally been rejected on the ground of obviousness-type double patenting over claims 1 and 3-9 of the co-pending application (see below). Appellants, Appellants' representative or the Assignee are not aware of any other prior and pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

The status of the claims is as follows:

Claims 1-16 are pending in this application.

Each of claims 1-16 is indicated as rejected in the Office Action mailed March 21, 2008.

The rejection of each of claims 1-16 is under appeal. Claims 1-16 involved in the appeal are reproduced in the Claims Appendix attached hereto.

IV. STATUS OF AMENDMENTS

No Amendment has been filed subsequent to the Office Action mailed March 21, 2008.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A. Claim 1

Independent claim 1 is drawn to a method for producing expandable beads of a styrene-modified linear low-density polyethylene-based resin. The method comprises the following steps in the order recited:

dispersing 100 parts by weight of non-crosslinked linear low-density polyethylene-based resin beads, 50 to 1000 parts by weight of a styrene-based monomer, and 0.1 to 0.9 parts by weight of a polymerization initiator relative to 100 parts by weight of the styrene-based monomer into a suspension containing a dispersant;

impregnating the styrene-based monomer into the low-density polyethylene-based resin beads by heating the resultant dispersion at such a temperature that polymerization of the styrene-based monomer does not substantially take place;

performing polymerization of the styrene-based monomer at a temperature of (T-15) to (T-8) °C or (T+1) to (T+5) °C (where T °C is the melting point of the low-density polyethylene-based resin beads); and

impregnating a volatile blowing agent into the resin beads during or after the polymerization,

whereby resin components of the expandable beads contain a gel component comprising less than 2 wt% of a graft polymer.

See, e.g., page 6, line 4 to page 7, line 2 of the present specification.

B. Claim 3

Independent claim 3 is drawn to a method for producing expandable beads of a styrene-modified linear low-density polyethylene-based resin. The method comprises the following steps in the order recited:

dispersing 100 parts by weight of non-crosslinked linear low-density polyethylene-based resin beads, 30 to 300 parts by weight of a styrene-based monomer, and 0.1 to 0.9 parts by weight of a polymerization initiator relative to 100 parts by weight of the styrene-based monomer into a suspension containing a dispersant;

impregnating the styrene-based monomer into the low-density polyethylene-based resin beads by heating the resultant dispersion at such a temperature that polymerization of the styrene-based monomer does not substantially take place;

performing a first polymerization of the styrene-based monomer at a temperature of (T-15) to (T-8) °C or (T+1) to (T+5) °C (where T °C is the melting point of the low-density polyethylene-based resin beads);

adding a styrene-based monomer and 0.1 to 0.9 parts by weight of a polymerization initiator relative to 100 parts by weight of the styrene-based monomer when a polymerization conversion ratio reaches 80 to 99.9%, and performing impregnation of the styrene-based monomer into the low-density polyethylene-based resin beads and a second polymerization of the styrene-based monomer at a temperature of (T-15) to (T-8) °C or (T+1) to (T+5) °C (where T °C is a melting point of the polyethylene-based resin beads) (wherein the total amount of the

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styrene monomers used in the first and second polymerizations is more than 50 parts by weight and not more than 1000 parts by weight relative to 100 parts by weight of the low-density polyethylene-based resin beads); and

impregnating a volatile blowing agent into the resin beads during or after the polymerization,

whereby resin components of the expandable beads contain a gel component comprising less than 2 wt% of a graft polymer.

See, e.g., page 7, line 3 to page 8, line 15 of the present specification.

C. Claim 5

Independent claim 5 is drawn to expandable beads of a styrene-modified linear low-density polyethylene-based resin comprising a volatile blowing agent and a base resin. The base resin contains more than 50 to 1000 parts by weight of a polystyrene-based resin component relative to 100 parts by weight of a non-crosslinked linear low-density polyethylene-based resin component, and contains less than 2 wt% of a gel component comprising a graft polymer of the polystyrene-based resin component and the low-density polyethylene-based resin component.

See, e.g., page 8 line 16 to page 9, line 1 of the present specification.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The broad issues under consideration are:

1. Whether claims 1, 2, 6 and 7 are properly rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over JP 1-284536 to Takasama et al. (hereafter "TAKASAMA")

when considered with the allegedly admitted prior art in the instant specification and in particular, whether the disclosure of TAKASAMA in combination with the prior art allegedly admitted in the present specification is sufficient to establish a *prima facie* case of obviousness of the subject matter of claims 1, 2, 6 and 7.

2. Whether claims 12 and 15 are properly rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over TAKASAMA and the prior art allegedly admitted in the present specification and further in view of Smith et al., U.S. Patent No. 3,963,816 (hereafter “SMITH”) and in particular, whether the disclosures of TAKASAMA and SMITH in combination with the prior art allegedly admitted in the present specification are sufficient to establish a *prima facie* case of obviousness of the subject matter of claims 12 and 15.

3. Whether claim 4 is properly rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over TAKASAMA and the prior art allegedly admitted in the present specification and further in view of Senda et al., U.S. Patent No. 4,368,218 (hereafter “SENDA”) and in particular, whether the disclosures of TAKASAMA and SENDA in combination with the prior art allegedly admitted in the present specification are sufficient to establish a *prima facie* case of obviousness of the subject matter of claim 4.

4. Whether claims 11 and 14 are properly rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over TAKASAMA and the prior art allegedly admitted in the present specification and further in view of SMITH and in particular, whether the disclosures of TAKASAMA and SMITH in combination with the prior art allegedly admitted in the present specification are sufficient to establish a *prima facie* case of obviousness of the subject matter of claims 11 and 14.

5. Whether claims 3 and 8 are properly rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over TAKASAMA and the prior art allegedly admitted in the present specification and further in view of Wicher et al., U.S. Patent No. 6,608,150 (hereafter “WICHER”) and in particular, whether the disclosures of TAKASAMA and WICHER in combination with the prior art allegedly admitted in the present specification are sufficient to establish a *prima facie* case of obviousness of the subject matter of claims 3 and 8.

6. Whether claims 13 and 16 are properly rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over TAKASAMA and the prior art allegedly admitted in the present specification and in view of WICHER and further in view of SMITH and in particular, whether the disclosures of TAKASAMA, WICHER and SMITH in combination with the prior art allegedly admitted in the present specification are sufficient to establish a *prima facie* case of obviousness of the subject matter of claims 13 and 16.

7. Whether claim 5 is properly rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over TAKASAMA when considered with the allegedly admitted prior art in the instant specification and in particular, whether the disclosure of TAKASAMA in combination with the prior art allegedly admitted in the present specification is sufficient to establish a *prima facie* case of obviousness of the subject matter of claim 5.

8. Whether claims 9 and 10 are properly rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over TAKASAMA and the prior art allegedly admitted in the present specification and further in view of SMITH and in particular, whether the disclosures of TAKASAMA and SMITH in combination with the prior art allegedly admitted in the present

specification are sufficient to establish a *prima facie* case of obviousness of the subject matter of claims 9 and 10.

9. Whether claims 1-16 are properly provisionally rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1 and 3-9 of co-pending application No. 10/541,391.

VII. ARGUMENTS

A. Citation of Authority

Obviousness

The appropriate starting point for a determination of obviousness is stated in *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 U.S.P.Q. 459, 466 (1966):

Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined.

The test of obviousness *vel non* is statutory and requires a comparison of the claimed subject matter as a whole with the prior art to which the subject matter pertains. *In re Brouwer*, 77 F.3d, 422, 37 U.S.P.Q. 2d 1663 (Fed. Cir. 1996); *In re Ochiai*, 71 F.3d 1565, 37 U.S.P.Q. 2d 1127 (Fed. Cir. 1995).

Often, it will be necessary to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.

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This analysis should be made explicit. There must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-1741. "A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." *Id.*, at 1741.

"If the Examiner fails to establish a *prima facie* case, the rejection is improper and will be overturned." *In re Rijckaert*, 9 F.3d, 1532, 28 U.S.P.Q.2d, 1956 (Fed. Cir. 1993), citing *In re Fine*, 837 F.2d 1071, 1074, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

B. Claims 1, 2, 6 and 7 Are Not Properly Rejected Under 35 U.S.C. § 103(a) As Being Unpatentable Over TAKASAMA When Considered in Combination With The Prior Art Allegedly Admitted In The Instant Specification

1. Summary of Rejection

The rejection essentially alleges that TAKASAMA teaches a method of the type recited in present claim 1. The rejection concedes that TAKASAMA does not teach the amount of polymerization initiator recited in present claim 1 and acknowledges that the polymerization of the vinyl-aromatic (e.g. styrene) monomer taught by TAKASAMA is carried out at a temperature outside the temperature ranges recited in present claim 1, i.e., at a temperature of 115 °C (which is (T-7) °C based on the melting point T of the polyethylene-based resin beads of 122 °C as specified at page 3, lines 22-25 of the present specification). The rejection further

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concedes that TAKASAMA does not disclose the specific weight percentage of the gel component comprising the graft polymer of polystyrene on the polyethylene chain. However, despite the fact that the rejection concedes that TAKASAMA does not disclose the polymerization temperature and the amount of polymerization initiator recited in present claim 1 the rejection alleges that TAKASAMA “teaches all of the claimed ingredient(s), and process limitation(s)”, wherefore “the claimed effects and physical properties, i.e. a gel component comprising less than 2 wt% of a graft polymer, would intrinsically be achieved by a composition with all the claimed ingredients”. Page 4, last paragraph of Office Action of March 21, 2008. The Examiner fails to state any reason as to why in view of the teaching of TAKASAMA it allegedly would have been obvious to one of ordinary skill in the art to employ, e.g., an amount of polymerization initiator which is outside the range taught by TAKASAMA and within the range recited in present claim 1 and to carry out the polymerization of the vinyl-aromatic monomer within the temperature ranges recited in present claim 1.

2. Response

- a. **The polymerization temperature ranges recited in claim 1 are critical for obtaining a low gel fraction of the modified expandable beads and high strength properties of expanded molded articles made therefrom**

Present claim 1 recites, *inter alia*, that the resin components of the expandable resin beads contain a gel component comprising less than 2 wt% of a graft polymer. A low gel fraction of the resin beads is desirable because a high gel fraction of the resin beads renders the recycling of an expanded molded product made from these beads difficult. In this regard, page 1, line 15 to

page 5, line 5 and in particular, page 4, line 13 to page 5, line 5 of the present specification may, for example, be referred to.

The present inventors have surprisingly found that the polymerization of a styrene-based monomer in the presence of linear low density polyethylene-based resin beads results in expandable polystyrene-modified beads which (a) have a gel component (gel fraction) comprising polystyrene graft copolymer of less than 2 wt% (which is advantageous, e.g., for later recycling) and (b) provide an expanded molded article which exhibits sufficient toughness of polyethylene and sufficient stiffness of polystyrene (only) if a method of the type described by TAKASAMA is carried out under certain reaction conditions, i.e.,

- (i) by conducting the polymerization of the styrene-based monomer within the temperature range of from (T-15) to (T-8) °C or from (T+1) to (T+5) °C (where T °C is the melting point of the low-density polyethylene-based resin beads), and
- (ii) by using a lower amount of polymerization initiator than that taught by TAKASAMA, i.e., 0.1 to 0.9 parts by weight of polymerization initiator relative to 100 parts by weight of styrene-based monomer instead of 1.0 to 3.0 parts by weight of polymerization initiator relative to 100 parts by weight of vinyl-aromatic monomer as taught by TAKASAMA.

In this regard see, e.g., page 5, line 8 to page 6, line 2 of the present specification.

The above-noted beneficial effects associated with the method recited in present claim 1 are illustrated by the results reported in the Examples and Comparative Examples of the present specification.

Specifically, Example 13 and Table 5 at pages 55 and 56 of the present specification and in particular, Fig. 1 (which is a graphic representation of the results set forth in Table 5) show the (significant) effect of the polymerization temperature on the gel fraction of the resultant styrene-modified linear low density polyethylene-based resin beads.

In particular, under otherwise identical conditions (except for the type of polymerization initiator to account for the different temperatures at which polymerization initiators are activated), the gel fraction of the beads is at most 1.8 % by weight if the polymerization of styrene is carried out at a temperature between 110 °C and 118 °C ((T-16) to (T-8) °C, based on a melting point of the polyethylene-based resin beads of 126 °C as set forth in Example 1 at page 29, line 2 of the present specification) or at temperatures of 128 °C or 130 °C ((T+2) or (T+4) °C). The gel fraction increases to more than 2 wt% and up to 32.2 wt% if the polymerization of styrene is carried out within the temperature range of from 119 °C to 126 °C ((T-7) to T °C) or at a temperature of 132 °C or 135 °C ((T+6) or (T+9) °C).

Regarding the polymerization of styrene at 110 °C ((T-16) °C) it can further be taken from the results summarized in Table 5 that while the gel fraction of the resultant beads is less than 2 wt%, i.e., 0.6 wt%, the falling ball impact value of the expanded molded article made therefrom is significantly lower than the corresponding values for the remaining expanded molded articles tested (50 cm vs. at least 80 cm).

The results summarized in Table 5 are confirmed by the results obtained in Examples 1 and 4 and Comparative Examples 2 to 7 which are summarized in Tables 1 and 2 at pages 47 and 48 of the present specification. The corresponding polymerization reactions were again carried out under identical conditions except for the polymerization temperature (and in the case of {P28094 00524177.DOC}

Example 4 the polymerization initiator). The corresponding results show that at temperatures of 117 °C and 130 °C ((T-9) and (T+4) °C) gel fractions of 0.3 wt% and 0.8 wt% respectively were obtained, whereas polymerization temperatures of from 119 °C to 125 °C ((T-7) to (T-1) °C) and of 135 °C ((T+9) °C) resulted in beads having gel fractions of from 4.6 wt% to 32.2 wt%.

The results discussed above provide clear evidence that a polymerization temperature of the styrene-based monomer within the ranges recited in present claim 1 is critical for the obtainment of modified linear low density polyethylene resin beads which have a gel fraction of less than 2 wt% and which can be made into expanded molded articles with satisfactory strength properties.

b. The amount of polymerization initiator recited in claim 1 is critical for obtaining a high strength properties of expanded molded articles made from the expandable modified beads

A comparison of the results obtained in Comparative Example 2 with the results obtained in Comparative Examples 8 and 9 of the present application shows that the amount of polymerization initiator within the range recited in present claim 1 is critical for obtaining modified resin beads from which expanded molded articles with satisfactory strength properties can be made. Specifically, if the amount of polymerization initiator used in Comparative Example 2 (conducted at a polymerization temperature of (T-7) °C) is increased from 0.3 parts by weight relative to 100 parts by weight of the styrene monomer (see page 41, lines 10-12 in combination with page 29, lines 19-21 of the present specification) to 1.2 parts by weight relative to 100 parts by weight of the styrene monomer (Comparative Examples 8 and 9), the strength of the a molded expanded article made therefrom deteriorates, regardless of whether the

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polymerization is carried out at a temperature outside (Comparative Example 8, (T-7) °C) or inside (Comparative Example 9, (T-9) °C) the ranges recited in present claim 1. In these cases the polymerization temperature affects only the gel fraction of the corresponding beads (6.5 wt% and 4.5 wt% for Comparative Examples 2 and 8 and 0.9 wt% for Comparative Example 9).

c. TAKASAMA fails to teach or suggest the criticality of the polymerization temperature and the amount of polymerization initiator for obtaining the favorable results described in the present specification

TAKASAMA neither teaches nor suggests that the polymerization temperature of the vinyl-aromatic monomer has an effect on the gel fraction of the resultant modified resin beads, let alone that by keeping the polymerization temperature within the ranges recited in present claim 1 modified resin beads which have a gel fraction of less than 2 wt% and from which expanded molded articles having satisfactory strength properties can be obtained. In fact, TAKASAMA appears to be completely silent as to any effects the polymerization temperature may have, and the polymerization temperature actually employed in the Example of TAKASAMA is (T-7) °C, i.e., outside the ranges recited in present claim 1.

Further, TAKASAMA not only fails to teach or suggest that by using an amount of polymerization initiator within the range of from 0.3 to 0.9 parts by weight relative to 100 parts by weight of the styrene-based monomer any favorable properties can be obtained, but even teaches that the amount of polymerization initiator must be higher than the amount recited in present claim 1, i.e., at least 1.0 parts by weight (and up to 3.0 parts by weight) relative to 100

parts by weight of the vinyl-aromatic monomer, thereby teaching away from the method of present claim 1.

d. Claims 2, 6 and 7

Appellants submit that in view of the foregoing facts it is apparent that the Examiner has failed to establish a *prima facie* case of obviousness of the subject matter of present claim 1 in view of TAKASAMA in combination with the prior art allegedly admitted in the present specification. The same applies to the subject matter of claims 2, 6 and 7.

Specifically, claim 2 differs from claim 1 merely in that the amount of styrene-based monomer is from 50 to 300 instead of from 50 to 1000 parts by weight per 100 parts by weight of non-crosslinked linear low density polyethylene-based resin beads. Claims 6 and 7 are drawn to expandable beads obtained by the methods of claims 1 and 2 respectively. Since these resin beads exhibit, *inter alia*, a gel fraction of less than 2 wt% and TAKASAMA fails to teach or suggest polymerization conditions for the vinyl-aromatic monomer which would result in such a low gel fraction, the resin beads of claims 6 and 7 are not rendered obvious by TAKASAMA, either.

C. Claims 12 and 15 Are Not Properly Rejected Under 35 U.S.C. § 103(a) As Being Unpatentable Over TAKASAMA In View Of SMITH When Considered in Combination With The Prior Art Allegedly Admitted In The Instant Specification

Claims 12 and 15 are drawn to pre-expanded beads having a bulk density of 20 to 200 kg/m³ which are obtained by pre-expanding the expandable beads of claim 7 (obtained by the

method of claim 2) and to an expanded molded article having a density of 20 to 200 kg/m³ which is obtained by expansion molding of these pre-expanded beads, respectively.

The pre-expanded beads of claim 12 are made from the expandable beads of claim 7 and the expanded molded article of claim 15 is made from the pre-expanded beads of claim 12. Consequently the pre-expanded beads and the expanded molded article exhibit, *inter alia*, a gel fraction of less than 2 wt% (which is advantageous in particular, for later recycling). As set forth in detail above in section VII.B.2., TAKASAMA fails to teach or suggest polymerization conditions for the vinyl-aromatic monomer in the production of the modified beads taught therein which would result in a gel fraction of less than 2 wt%, thereby being unable to render obvious the pre-expanded beads and the expanded molded article of claims 12 and 15.

SMITH is unable to cure the deficiencies of TAKASAMA in this regard. In fact, the disclosure of SMITH is limited to processes for the production of molded articles from expandable thermoplastic resin material and does not at all contain any teaching as to the production of the starting materials (such as, e.g., expandable resin beads) for the processes disclosed therein.

In view of the foregoing it is submitted that for at least the reasons set forth above, the Examiner also has failed to establish a *prima facie* case of obviousness with respect to the subject matter of present claims 12 and 15.

D. Claim 4 Is Not Properly Rejected Under 35 U.S.C. § 103(a) As Being Unpatentable Over TAKASAMA In View Of SENDA When Considered in Combination With The Prior Art Allegedly Admitted In The Instant Specification

Claim 4 is drawn to the method of claim 1 wherein the low-density polyethylene-based resin beads each have a substantially spherical shape or a cylindrical shape having an L/D (where L is a length of each bead and D is a diameter of each bead) of 0.6 to 1.6, and an average bead size of 0.2 to 1.5 mm.

Because the method of claim 4 is a method according to claim 1 it affords modified resin beads having a gel fraction of less than 2 wt%. As set forth in detail in section VII.B.2. above, TAKASAMA fails to teach or suggest polymerization conditions for the vinyl-aromatic monomer and in particular, polymerization temperatures which would result in such a gel fraction of less than 2 wt%.. For this reason alone, TAKASAMA is unable to render obvious the method of claim 4.

SENDA is unable to cure the deficiencies of TAKASAMA set forth above. In fact, the process for the production of expandable resin beads disclosed in SENDA is completely different from that disclosed in TAKASAMA (see, e.g., abstract and claims of SENDA) and moreover, SENDA does not appear to teach that the polymerization temperature has any effect on the properties of the beads made by a method of the type taught by TAKASAMA (or any other method).

In view of the foregoing it is submitted that for at least the reasons set forth above, the Examiner also has failed to establish a *prima facie* case of obviousness with respect to the subject matter of present claim 4.

E. Claims 11 and 14 Are Not Properly Rejected Under 35 U.S.C. § 103(a) As Being Unpatentable Over TAKASAMA In View Of SMITH When Considered in Combination With The Prior Art Allegedly Admitted In The Instant Specification

Claims 11 and 14 are drawn to pre-expanded beads having a bulk density of 20 to 200 kg/m³ which are obtained by pre-expanding the expandable beads of claim 6 (obtained by the method of claim 1) and to an expanded molded article having a density of 20 to 200 kg/m³ which is obtained by expansion molding of these pre-expanded beads, respectively.

The pre-expanded beads of claim 11 are made from the expandable beads of claim 6 and the expanded molded article of claim 14 is made from the pre-expanded beads of claim 11. Consequently the pre-expanded beads and the expanded molded article exhibit, *inter alia*, a gel fraction of less than 2 wt% (which is advantageous in particular, for later recycling). As set forth in detail above in section VII.B.2., TAKASAMA fails to teach or suggest polymerization conditions for the vinyl-aromatic monomer in the production of the modified beads taught therein which would result in a gel fraction of less than 2 wt%, thereby being unable to render obvious the pre-expanded beads and the expanded molded article of claims 11 and 14.

SMITH is unable to cure the deficiencies of TAKASAMA in this regard. In fact, the disclosure of SMITH is limited to processes for the production of molded articles from expandable thermoplastic resin material and does not at all contain any teaching as to the production of the starting materials (such as, e.g., expandable resin beads) for the processes disclosed therein.

In view of the foregoing it is submitted that for at least the reasons set forth above, the Examiner also has failed to establish a *prima facie* case of obviousness with respect to the subject matter of present claims 11 and 14.

F. Claims 3 and 8 Are Not Properly Rejected Under 35 U.S.C. § 103(a) As Being Unpatentable Over TAKASAMA In View Of WICHER When Considered in Combination With The Prior Art Allegedly Admitted In The Instant Specification

1. Summary of Rejection

The rejection of claims 3 and 8 is similar to that of claims 1, 2, 6 and 7 summarized in section VII.B.1. above. Additionally, the rejection concedes that TAKASAMA does not disclose a second polymerization in the method for producing expandable beads disclosed therein. In this regard, the rejection relies on WICHER and essentially alleges that this document teaches a step-wise process for polymerizing styrene using two different temperature stages and two different polymerization initiators which are activated at two different temperatures. The rejection further asserts that “it would have been obvious to a person of ordinary skill in the art to include an additional polymerization step in the process described by [TAKASAMA]. The motivation would have been that an additional polymerization step would be to provide for a more complete polymerization of styrene, thereby reducing monomer content to acceptable levels for commercial processing”. Page 10, first paragraph of the March 21, 2008 Office Action.

2. Response

a. There is no motivation for one of ordinary skill in the art to combine the teachings of TAKASAMA and WICHER

Contrary to what is asserted in the present Office Action, there is no apparent reason for one of ordinary skill in the art to combine the teachings of TAKASAMA and WICHER. Specifically, TAKASAMA is concerned with the modification of pre-formed beads of an LLDPE-based resin by incorporating polystyrene into these beads, whereas WICHER is concerned with the production of polystyrene beads from scratch. In other words, the only thing that TAKASAMA and WICHER have in common is that the final products of the methods disclosed therein are beads and that these beads comprise polystyrene. However, in one case the beads are already pre-formed at the beginning of the method (TAKASAMA), whereas in the other case (WICHER) the beads are made from scratch. Also, the beads are of a very different nature, i.e., in one case (TAKASAMA) they are (polystyrene-modified) LLDPE-based resin beads and in the other case they are (plain) polystyrene beads.

Yet another reason why there is no motivation for one of ordinary skill in the art to combine the teachings of TAKASAMA and WICHER is that TAKASAMA requires the use of at least 1.0 parts by weight of polymerization initiator per hundred parts by weight of vinyl-aromatic monomer, whereas in all of the Examples of WICHER the total amount of the mixture of polymerization initiators employed is significantly lower, i.e., less than 0.5 parts by weight of styrene.

b. TAKASAMA in view of WICHER is unable to render obvious the polymerization temperature ranges and amount of polymerization initiator recited in claim 3

Even if one were to assume, *arguendo*, that there is a motivation for one of ordinary skill in the art to combine the teachings of TAKASAMA and WICHER, this combination would not render obvious the method of claim 3. Specifically, the method of claim 3 and the method of claim 1 have in common, *inter alia*, that the temperature ranges for the polymerization of the styrene-based monomer, the amount of polymerization initiator and the (low) gel fraction of the resultant modified beads recited therein are the same. As set forth in detail in section VII.B.2. above, TAKASAMA is unable to render obvious these features and the advantageous effects associated therewith. In this regard, see also the results described in Example 2 and Comparative Examples 8 and 9 of the present specification (which specifically relate to the method of claim 3).

WICHER is unable to cure the deficiencies of TAKASAMA in this regard. Specifically, WICHER is not concerned with the production of (linear low density polyethylene-based) expandable beads which are modified by polystyrene, but with the production of expandable polystyrene beads by polymerization of styrene. Accordingly, the problem of having a high gel fraction comprising a graft polymer (i.e., a graft copolymer of polystyrene onto polyethylene) cannot even arise in the method of WICHER. Moreover, WICHER clearly fails to teach or suggest that by carrying out a polymerization of vinyl-aromatic monomer in the method of TAKASAMA within the temperature ranges recited in present claim 3 (and claim 1) any advantages can be obtained, let alone that by doing so the gel fraction of the resultant modified

expandable beads can be kept below 2 wt% and an expanded molded article having satisfactory strength properties can be made therefrom. For this reason alone, TAKASAMA in view of WICHER in combination with the prior art allegedly admitted in the present specification is unable to render obvious the method recited in claim 3.

c. WICHER fails to teach or suggest conducting a multi-step polymerization in the method of TAKASAMA

Claim 3 further differs from claim 1, *inter alia*, in that it recites that the polymerization of the styrene-based monomer is conducted in more than one stage, with the styrene-based monomer being added in at least two portions. As set forth in e.g., the passage from page 18, line 20 to page 19, line 13 of the present specification, the step-wise impregnation of styrene-based monomer into the resin beads to be modified is advantageous especially when the amount of styrene-based monomer exceeds the maximum amount of vinyl-aromatic monomer taught by TAKASAMA, i.e., 300 parts by weight relative to 100 parts by weight of unmodified resin beads because in this case there is a risk that a significant amount of the styrene-based monomer is polymerized before it gets impregnated into the resin beads and thus, too much vinyl-aromatic polymer powder is present outside the modified resin beads at the end of the method. Since WICHER is not concerned with the impregnation of styrene monomer into expandable resin beads and the subsequent polymerization of the styrene monomer inside these resin beads, WICHER is unable to provide an apparent reason for one of ordinary skill in the art to modify the method disclosed by TAKASAMA by first adding 30 to 300 parts by weight of styrene-based monomer relative to 100 parts by weight of unmodified resin beads and converting 80 to 99.9 %

of the styrene-based monomer (within the temperature ranges recited in instant claim 3) and thereafter adding the remainder of the styrene-based monomer (up to a total of 1000 parts by weight of styrene-based monomer) and then completing the polymerization. WICHER does not even specify what the conversion of styrene monomer before conducting the polymerization with the second polymerization initiator should be.

d. WICHER fails to teach or suggest a step-wise addition and polymerization of styrene-based monomer

Even if one were to assume, *arguendo*, that WICHER renders it obvious to conduct a multi-step polymerization in the method of TAKASAMA, Appellants note that present claim 3 also recites, *inter alia*, the addition (and impregnation) of the styrene-based monomer to the LLDPE-based resin beads in a first step and in a second step, each of these two steps followed by a polymerization of the styrene-based monomer. As conceded by the Examiner, TAKASAMA fails to disclose more than one polymerization step in the method disclosed therein. Further, even if the method of TAKASAWA were modified according to the teaching of WICHER, the corresponding method would comprise the addition (and impregnation) of the styrene monomer in a single step, followed by a polymerization (arguably in two steps).

In particular, it is noted that as can be seen from the Examples of WICHER, all of the styrene monomer to be polymerized, with the exception of about 5 % used for dissolving the polymerization initiators before adding them to the reaction vessel, is present already at the beginning of the process. Even if one took the position that the styrene is added in two separate portions (about 95 % and about 5 %), the fact remains that the polymerization is initiated only

after all of the styrene monomer has been added to the reaction vessel. In other words, even in this case the second (5 %) addition of styrene monomer is not followed by a second polymerization step.

Appellants note that the fact that in a method of TAKASAMA as modified by WICHER the entire styrene-based monomer would already be present at the beginning of the polymerization causes one of the problems the method of claim 3 seeks to overcome, i.e., that particularly if a relatively large amount of styrene-based monomer is employed, the amount of styrene-based monomer that is polymerized before it is impregnated into the resin beads (and thus, is present as a polymer powder, e.g., on the outer surfaces of the resin particles) may reach a level which has a significant adverse effect on the physical strength and other properties of expanded molded articles made from the modified expandable beads.

e. Claim 8

Appellants submit that for at least all of the foregoing reasons, the Examiner has failed to establish a *prima facie* case of obviousness of the subject matter of present claim 3 in view of TAKASAMA and WICHER in combination with the prior art allegedly admitted in the present specification. The same applies to the subject matter of claim 8.

Specifically, claim 8 is drawn to expandable beads obtained by the method of claims 3. Since these resin beads exhibit, *inter alia*, a gel fraction of less than 2 wt% and TAKASAMA in view of WICHER fails to teach or suggest polymerization conditions for the vinyl-aromatic monomer which would result in such a low gel fraction, the resin beads of claim 8 are not rendered obvious by TAKASAMA in view of WICHER, either.

G. Claims 13 and 16 Are Not Properly Rejected Under 35 U.S.C. § 103(a) As Being Unpatentable Over TAKASAMA In View Of WICHER And Further In View Of SMITH When Considered in Combination With The Prior Art Allegedly Admitted In The Instant Specification

Claims 13 and 16 are drawn to pre-expanded beads having a bulk density of 20 to 200 kg/m³ which are obtained by pre-expanding the expandable beads of claim 8 (obtained by the method of claim 3) and to an expanded molded article having a density of 20 to 200 kg/m³ which is obtained by expansion molding of these pre-expanded beads, respectively.

The pre-expanded beads of claim 13 are made from the expandable beads of claim 8 and the expanded molded article of claim 16 is made from the pre-expanded beads of claim 13. Consequently, the pre-expanded beads and the expanded molded article exhibit, *inter alia*, a gel fraction of less than 2 wt% (which is advantageous in particular, for later recycling). As set forth in detail above in sections VII.B.2. and VII.F.2, TAKASAMA in view of WICHER fails to teach or suggest polymerization conditions for the vinyl-aromatic monomer in the production of the modified beads taught therein which would result in a gel fraction of less than 2 wt%, thereby being unable to render obvious the pre-expanded beads and the expanded molded article of claims 13 and 16.

SMITH is unable to cure the deficiencies of TAKASAMA and WICHER in this regard. In fact, the disclosure of SMITH is limited to processes for the production of molded articles from expandable thermoplastic resin material and does not at all contain any teaching as to the production of the starting materials (such as, e.g., expandable resin beads) for the processes disclosed therein.

In view of the foregoing it is submitted that for at least all of the reasons set forth above, the Examiner also has failed to establish a *prima facie* case of obviousness with respect to the subject matter of present claims 13 and 16.

H. Claim 5 Is Not Properly Rejected Under 35 U.S.C. § 103(a) As Being Unpatentable Over TAKASAMA When Considered in Combination With The Prior Art Allegedly Admitted In The Instant Specification

1. Summary of Rejection

The rejection alleges, *inter alia*, that in the present specification it allegedly is admitted that the resin components of the expandable beads of TAKASAMA contain a gel component comprising a graft polymer of polystyrene on the polyethylene chain, but concedes that the specific percentage of the gel component comprising the gel component comprising the graft polymer is not disclosed. In this regard, the rejection appears to allege that less than 2 wt% of gel component as recited in claim 5 would inherently be achieved by following the teaching of TAKASAMA.

2. Response

As set forth in detail specifically in section VII.B.2. above, TAKASAMA neither teaches nor suggests conducting the polymerization of the vinyl-aromatic monomer under specific temperature conditions, let alone for achieving a particular result such as the gel content recited in present claim 5. Moreover, the polymerization temperature disclosed in the Example of TAKASAMA, i.e., 115 °C (see page 4, line 14 from the bottom of the machine translation of TAKASAMA submitted with the Information Disclosure filed February 2, 2007), is (T-7) °C and

thus, outside the temperatures ranges which are shown in the Examples of the present specification to be effective for achieving a gel fraction of less than 2 wt.%. In fact, the results set forth in Table 5 of the present specification show a gel fraction at a temperature of 119 °C (= (T-7) °C based on a melting temperature T of 126 °C of the polyethylene beads employed in the Examples and Comparative Examples described in the present specification) of 6.5 wt.%, i.e. more than 3 times the amount recited in present claim 5.

Appellants submit that for at least all of the foregoing reasons, the Examiner has failed to establish a *prima facie* case of obviousness of the subject matter of present claim 5 in view of TAKASAMA in combination with the prior art allegedly admitted in the present specification.

I. Claims 9 and 10 Are Not Properly Rejected Under 35 U.S.C. § 103(a) As Being Unpatentable Over TAKASAMA In View Of SMITH When Considered in Combination With The Prior Art Allegedly Admitted In The Instant Specification

Claims 9 and 10 are drawn to pre-expanded beads having a bulk density of 20 to 200 kg/m³ which are obtained by pre-expanding the expandable beads of claim 5 and to an expanded molded article having a density of 20 to 200 kg/m³ which is obtained by expansion molding of these pre-expanded beads, respectively.

The pre-expanded beads of claim 9 are made from the expandable beads of claim 5 and the expanded molded article of claim 10 is made from the pre-expanded beads of claim 10. Consequently, the pre-expanded beads and the expanded molded article exhibit, *inter alia*, a gel fraction of less than 2 wt% (which is advantageous in particular, for later recycling). As set forth in detail above in sections VII.B.2. and VII.H.2, TAKASAMA fails to teach or suggest

polymerization conditions for the vinyl-aromatic monomer in the production of the modified beads taught therein which would result in a gel fraction of less than 2 wt%, thereby being unable to render obvious the pre-expanded beads and the expanded molded article of claims 9 and 10.

SMITH is unable to cure the deficiencies of TAKASAMA in this regard. In fact, the disclosure of SMITH is limited to processes for the production of molded articles from expandable thermoplastic resin material and does not at all contain any teaching as to the production of the starting materials (such as, e.g., expandable resin beads) for the processes disclosed therein.

In view of the foregoing it is submitted that for at least the reasons set forth above, the Examiner also has failed to establish a *prima facie* case of obviousness with respect to the subject matter of present claims 9 and 10.

J. Claims 1-16 Are Not Properly Provisionally Rejected On The Ground Of Nonstatutory Obviousness-Type Double Patenting Over Claims 1 and 3-9 Of Application No. 10/541,391

1. Summary Rejection

The rejection merely alleges that each of the present claims “corresponds to” one of claims 1 and 3-9 of application No. 10/541,391, without providing any explanation as to why this alleged “correspondence” allegedly makes the subject matter of claims 1-16 obvious variants of the subject matter of claims 1 and 3-9.

2. Response

Present claims 1-16 all have in common that they recite, either directly or indirectly (by being dependent from a corresponding claim) a polymerization temperature of (T-15) to (T-8) °C or (T+1) to (T+5) °C (where T °C is the melting point of the low-density polyethylene-based resin beads) and/or resin components of the expandable beads which contain a gel component comprising less than 2 wt% of a graft polymer. In contrast, all of claims 1 and 3-9 of application No. 10/541,391 recite, either directly or indirectly, a polymerization temperature of higher than (T-8) °C or lower than (T+1) °C and/or resin components of the expandable beads which contain a gel component comprising 2 to 40 wt% of a graft polymer.

Accordingly, claims 1 and 3-9 of application No. 10/541,391 teach away from, rather than render obvious the subject matter of present claims 1 to 16, wherefore the instant provisional obviousness-type double patenting rejection of the latter claims over the former claims is without merit.

VIII. CONCLUSION

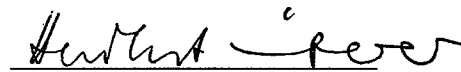
Appellants respectfully submit that for at least all of the foregoing reasons, the Examiner has failed to establish a *prima facie* case of obviousness of any of the rejected claims 1-16 over TAKASAMA, SMITH, SENDA and WICHER in combination with the prior art allegedly admitted in the present specification and over claims 1 and 3-9 of application No. 10/541,391.

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The Board is, therefore, respectfully requested to reverse the rejection of claims 1-16, and to allow the application to issue in its present form.

In this regard and to the extent it may be relevant, Appellants further submit that the Japanese Patent Office has allowed claims 1-4 and 6-16.

Respectfully submitted,
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CLAIMS APPENDIX

1. A method for producing expandable beads of a styrene-modified linear low-density polyethylene-based resin comprising, in the order recited, the steps of:

dispersing 100 parts by weight of non-crosslinked linear low-density polyethylene-based resin beads, 50 to 1000 parts by weight of a styrene-based monomer, and 0.1 to 0.9 parts by weight of a polymerization initiator relative to 100 parts by weight of the styrene-based monomer into a suspension containing a dispersant;

impregnating the styrene-based monomer into the low-density polyethylene-based resin beads by heating a resultant dispersion at such a temperature that polymerization of the styrene-based monomer does not substantially take place;

performing polymerization of the styrene-based monomer at a temperature of (T-15) to (T-8) °C or (T+1) to (T+5) °C (where T °C is a melting point of the low-density polyethylene-based resin beads); and

impregnating a volatile blowing agent into the resin beads during or after the polymerization,

whereby resin components of the expandable beads contain a gel component comprising less than 2 wt% of a graft polymer.

2. A method for producing expandable beads of a styrene-modified linear low-density polyethylene-based resin according to Claim 1, wherein the amount of the styrene-based monomer is 50 to 300 parts by weight.

3. A method for producing expandable beads of a styrene-modified linear low-density polyethylene-based resin comprising, in the order recited, the steps of:

dispersing 100 parts by weight of non-crosslinked linear low-density polyethylene-based resin beads, 30 to 300 parts by weight of a styrene-based monomer, and 0.1 to 0.9 parts by weight of a polymerization initiator relative to 100 parts by weight of the styrene-based monomer into a suspension containing a dispersant;

impregnating the styrene-based monomer into the low-density polyethylene-based resin beads by heating a resultant dispersion at such a temperature that polymerization of the styrene-based monomer does not substantially take place;

performing a first polymerization of the styrene-based monomer at a temperature of $(T-15)$ to $(T-8)$ °C or $(T+1)$ to $(T+5)$ °C (where T °C is a melting point of the low-density polyethylene-based resin beads);

adding a styrene-based monomer and 0.1 to 0.9 parts by weight of a polymerization initiator relative to 100 parts by weight of the styrene-based monomer when a conversion ratio of polymerization reaches to 80 to 99.9%, and performing impregnation of the styrene-based monomer into the low-density polyethylene-based resin beads and a second polymerization of the styrene-based monomer at a temperature of $(T-15)$ to $(T-8)$ °C or $(T+1)$ to $(T+5)$ °C (where T °C is a melting point of the polyethylene-based resin beads) (wherein a total amount of the styrene monomers used in the first and second polymerizations is more than 50 parts by weight and not more than 1000 parts by weight relative to 100 parts by weight of the low-density polyethylene-based resin beads); and

impregnating a volatile blowing agent into the resin beads during or after the polymerization,

whereby resin components of the expandable beads contain a gel component comprising less than 2 wt% of a graft polymer.

4. A method for producing expandable beads of a styrene-modified linear low-density polyethylene-based resin according to Claim 1, wherein the low-density polyethylene-based resin beads each have a substantially spherical shape or a cylindrical shape having an L/D (where L is a length of each bead and D is a diameter of each bead) of 0.6 to 1.6, and an average bead size of 0.2 to 1.5 mm.

5. Expandable beads of a styrene-modified linear low-density polyethylene-based resin comprising a volatile blowing agent and a base resin, the base resin containing more than 50 to 1000 parts by weight of a polystyrene-based resin component relative to 100 parts by weight of a non-crosslinked linear low-density polyethylene-based resin component, wherein the base resin contains less than 2 wt% of a gel component comprising a graft polymer of the polystyrene-based resin component and the low-density polyethylene-based resin component.

6. Expandable beads of a styrene-modified linear low-density polyethylene-based resin obtained by the method of Claim 1.

7. Expandable beads of a styrene-modified linear low-density polyethylene-based resin obtained by the method of Claim 2.

8. Expandable beads of a styrene-modified linear low-density polyethylene-based resin obtained by the method of Claim 3.

9. Pre-expanded beads having a bulk density of 20 to 200 kg/m³, obtained by pre-expanding the expandable beads of the styrene-modified linear low-density polyethylene-based resin of Claim 5.

10. An expanded molded article having a density of 20 to 200 kg/m³, obtained by expansion molding of the pre-expanded beads of Claim 9.

11. Pre-expanded beads having a bulk density of 20 to 200 kg/m³, obtained by pre-expanding the expandable beads of the styrene-modified linear low-density polyethylene-based resin of Claim 6.

12. Pre-expanded beads having a bulk density of 20 to 200 kg/m³, obtained by pre-expanding the expandable beads of the styrene-modified linear low-density polyethylene-based resin of Claim 7.

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13. Pre-expanded beads having a bulk density of 20 to 200 kg/m³, obtained by pre-expanding the expandable beads of the styrene-modified linear low-density polyethylene-based resin of Claim 8.

14. An expanded molded article having a density of 20 to 200 kg/m³, obtained by expansion molding of the pre-expanded beads of Claim 11.

15. An expanded molded article having a density of 20 to 200 kg/m³, obtained by expansion molding of the pre-expanded beads of Claim 12.

16. An expanded molded article having a density of 20 to 200 kg/m³, obtained by expansion molding of the pre-expanded beads of Claim 13.

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EVIDENCE APPENDIX

None.

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RELATED PROCEEDINGS APPENDIX

None.